appears to be very different in different places: no trace of such a change is found in the South of Scania. In those places where its amount was ascertained with greatest accuracy, it appears to be about three feet in a century. The phænomenon in question having excited increasing interest among the philosophers of Sweden, and having especially excited the attention of Professor Berzelius, it is to be hoped that the means of accurate determination will be greatly multiplied.

January 15, 1835.

JOHN WILLIAM LUBBOCK, Esq., M.A., V.P. and Treasurer, in the Chair.

Second Essay on a general Method in Dynamics. By William Rowan Hamilton, Esq., Andrew's Professor of Astronomy in the University of Dublin, and Royal Astronomer of Ireland. Communicated by Captain Beaufort, R.N., F.R.S.

This essay is a sequel of the one which appeared in the last volume of the Philosophical Transactions, and which contained a general method for reducing all the most important problems of dynamics to the study of one characteristic function, or one central or radical relation. It was there remarked that many eliminations required by this method might be avoided by a general transformation, introducing the time explicitly into a part (S) of the whole characteristic function (V); and the first object of the present essay is to examine and develope the properties of this part (S), which the author designates by the term *Principal Function*. This function is applied by the author to problems of perturbation, in which he finds it dispenses with many laborious and circuitous processes, and furnishes accurate expressions of the disturbed configurations of a system by the rules of undisturbed motion, if only the initial components of velocities be changed in a suitable manner. Another manner of extending rigorously to disturbed, the rules of undisturbed motion, by the gradual variation of elements, in number double the number of the coordinates or other marks of position of the system, which was first invented by Lagrange, and was afterwards improved by Poisson, is considered in this second essay under a form rather more general; and the general method of calculation which has already been applied by the author to other analogous questions in optics and in dynamics, is now applied to the integration of the equations which determine these elements. This general method is founded chiefly on a combination of the principle of variations with those of partial differentials, and may furnish, when matured, a separate branch of analysis, which may be denominated the *Calculus of Principal Functions*. When applied to the integration of the equations of varying elements, it suggests the consideration of a certain *Function of Elements*, capable of being variously transformed, and which may be either rigorously determined, or at least approached to, by a corollary of the general method. With a view to illustrate these new principles, and more especially those connected

with problems of perturbation, they are applied, in this essay, first, to a very simple example, suggested by the motions of projectiles, the parabolic path being treated as the undisturbed; and secondly, to the problem of determining the motions of a ternary or multiple system, with any laws of attraction or repulsion, and with one predominant mass. This latter problem, which was touched upon in the former essay, is here resumed in a new manner, by forming and integrating the differential equations of a new set of varying elements, entirely distinct in theory (though little differing in practice) from the elements conceived by Lagrange; and having this advantage, that the differentials of all the new elements for both the disturbed and disturbing masses may be expressed by the coefficients of one disturbing function.

An Account of the Eruption of Mount Etna in the year 1536, from an original cotemporary document, communicated in a letter to J. G. Children, Esq., Secretary of the Royal Society. By Sir Francis Palgrave, K.G.H., F.R.S.

Record Office of the Treasury, Chapter House,
Poets' Corner, Westminster, Jan. 14, 1835.

Amongst various shreds and fragments of the correspondence from Italy during the period that Henry VIII. was negotiating with the Italian princes, is a document of a very different nature from the rest, being an extract from a letter written by the Barone di Burgis, dated at Palermo, 10th of April 1536, and giving an account of the then recent eruption of Mount Etna.

" Die xxiij. Martii, M. D. xxxvi., nocte, Mons Ethna qui nunc Mongibellus vocatur; facto, orientem versus, ostio, emisit materiam igneam, quæ ad instar fluminis vagata est per octo miliaria in longitudine, et per unum miliare in latitudine; ejus vero altitudo erat palmarum duodecim. Eâdem nocte ignis extinctus est, et ubique remansit nigra materies prædictæ altitudinis duodecim palmarum. Ignis totam liquefecit nivem, quæ ad instar rapidi torrentis tanto impetu defluit, ut domus, arbores, et quicquid obviam esset secum traheret.

" Sequentibus autem diebus scissa sunt alia ostia numero tredecim, quæ miro strepitu ignem evomebant ad instar bombardarum; longeque ab his per unum miliare cadebant ingentia saxa, quorum aliquot judicata sunt ponderis ultra quindecim cantanorum. Post strepitum sequebatur odor sulphureus per aliquot miliaria in locis circumvicinis. Tantus erat impetus hujus igneæ materiei, ut arbores prostraret et evelleret antequam eas tangerat, sique veterem materiem incendiorum præteritorum sæculorum, offendebat, eam denuo incendebat.

" Ex quolibet ostio profluebant amplissimi rivi, qui aliquo in loco suâ latitudine unum miliare occupabant, erantque altitudine duodecim palmarum.

" Duravit hic ignis per sex dies, et singulâ quâque nocte aspiciebatur in cacumine montis, ignis; die vero, fumus.

" Sed cognosci nequibat quem faceret effectum, quia illuc ascendere non licebat propter relictam materiem incendii."